# How To Measure Turf Color to Guide Nitrogen Fertilization

Karl Guillard, Professor of Agronomy

Department of Plant Science & Landscape Architecture, University of Connecticut

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## Current Approach To Turf N Fertilization

- Follow established procedure based on past experience – usually Set Rate at Set Dates
- Follow directive from supervisor or boss
- Follow recommendations on fertilizer bag
- Feed only when turf looks "hungry"
- Follow advice of consultant or other expert
- Based on soil test
- Based on tissue test

## My Guess Most Use: Set Rate – Set Date

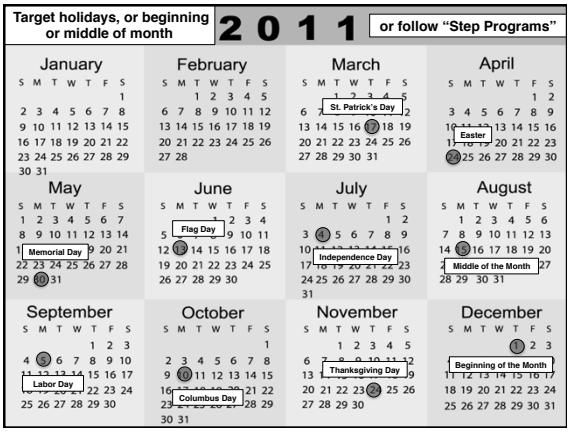
Typically 1 lb N/1000ft$^2$/application

2 to 4 times or more per season

Target holidays, or beginning or middle of month

2011

or follow "Step Programs"




## Why? 1 lb N/1000ft$^2$

Why not 0.75 lbs N/1000ft$^2$

Why not 0.50 lbs N/1000ft$^2$

Why not any X lbs N/1000ft$^2$

## Why? Set Calendar Dates

What Guides This?

## Current Approach To Turf N Fertilization

- Recommendations static last 30+ years (technology advances in fertilizers and equipment)
- Recommendations based entirely on grass agronomic and quality response; ignores economic and environmental consequences
- Does not account for inherent available N already existing in turf system
- Lags behind other economically important crops in determination of how much N to apply and when to apply

## *Arbitrary (Subjective) Approach*

- **Not defensible from science standpoint**
- **Easy decision for Regulators to restrict or regulate turf fertilization practices (water quality concerns; greenhouse gas emissions)**
- **May become one of your biggest liabilities**

**Outcome of Reliance on Arbitrary Set Rate-Set Date Approach to Turf N Fertilization**


## What About Following Soil Test Lab Recommendations For N?

## Most soil tests for turf ***do not measure for N***,

**Or, if they do, ***not used*** to guide fertilizer rates – lack of calibration studies**

**Consequently, ***same N fertilizer recommendations*** usually given regardless of site-specific conditions**

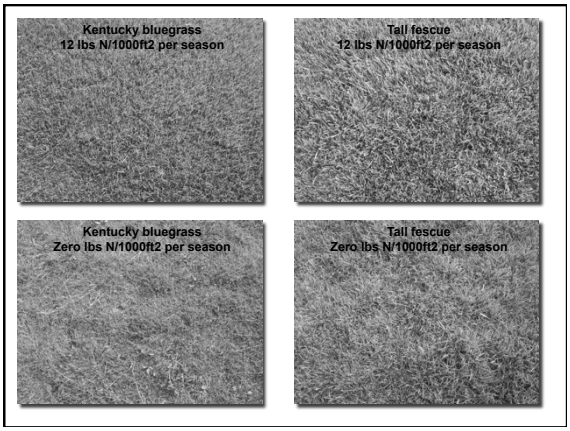
| Analysis | | Result | Optimal | Analysis | | Result | Optimal |
|---|---|---|---|---|---|---|---|
| Soil pH | | 5.6 | 6.0-6.8 | Sulfur | ppm | 18 | 20-40 |
| Buffer pH | | 6.8 | | Boron | ppm | 0.8 | 0.9-1.7 |
| Organic Matter | % | 3.3 | | Copper | index | 1.7 | 0.4-2.0 |
| CEC | | 7.4 | | Iron | ppm | 75 | 5-20 |
| K Saturation | % | 3.2 | 2.0-4.0 | Manganese | index | 38 | 19-50 |
| Mg Saturation | % | 13.8 | 10-20 | Zinc | ppm | 13 | 9-25 |
| Ca Saturation | % | 49.5 | 50-70 | Sodium | ppm | 21 | |
| Na Saturation | % | 1.2 | 0-10 | Soluble Salts | mmhos/cm | 0.15 | |
| K/Mg Ratio | | 0.7 | | Nitrate-N | ppm | 95 | |
| Ca/Mg Ratio | | 6.0 | | | | | |
| Phosphorus | ppm | 24 | 40-60 | | | | |
| Potassium | ppm | 92 | 110-190 | | | | |
| Magnesium | ppm | 124 | 130-250 | | | | |
| Calcium | ppm | 737 | 600-1100 | | | | |

Recommendations — Nutrients expressed in broadcast lbs/1000 sqft, except Fe (foliar) and Mn (row)

| Yr | Crop | CaCO3 | N | P2O5 | K2O | Mg | S | B | Cu | Fe | Mn | Zn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 03 | Bluegrass, Kentucky, Turf | 30D | 4.0 | 2.4 | 2.9 | 0.2 | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |

Lime expressed in 100% pure CaCO3. Adjust accordingly. D=Dolomitic. C=Calcitic.

**Bluegrass, Kentucky, Turf:** Where controlled release N is not used, split N application into thirds (March-May-Sept.). Monitor and adjust nutrient program with annual tissue analysis.

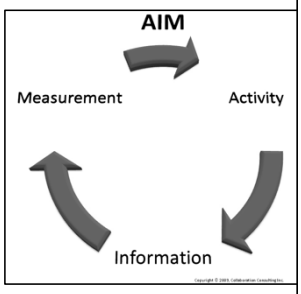


## Need to Change from:

**"Set Rate/Set Date"-Based N Fertilization**

**To**

**"Objective Measure-Based" N Fertilization**




## Objective Testing Not Synonymous with Less Fertilizer

- **Some sites will test lower than optimum – need fertilizer**
- **Some sites will test near optimum – will need a little fertilizer**
- **Some sites will test at or above optimum – no need for fertilizer at that time**

## What Approaches Can We Use for Objective Testing?

- **Reflectance meters to guide N fertilization**
- **Take *frequent* soil samples and test for nitrate; use results to guide N fertilization**
- **Tissue tests to guide N fertilization**

## Handheld Reflectance Meters that Measure Turf Color

**Minolta Chroma Meter**
**≈ $8,000**

**Spectrum CM1000 Chlorophyll Meter**
**CM1000 NDVI**
**≈ $2,500**

**Greenseeker RT100 NDVI Meter**
**≈ $5,500**

**Spectrum TCM500 NDVI Meter**
**≈ $700**

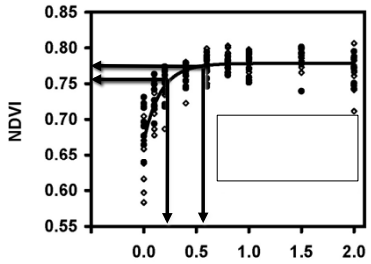
**Turf Color Will Reach Peak at Some Level of Available Soil Nitrogen**

**And Then Remains Constant (Plateau Response)**

## Practical Guidelines for Use:

- **Have Well-Fertilized Reference Strip at Site**
- **Collect Meter Measurements from Reference Strip**
- **Collect Measurements from Remaining Area and Compare to Reference Value**
- **If Within 90-95% of Reference; probably no need to Fertilize**
- **If Below 90-95%, then apply Fertilizer according to Percentage: More N if far below 90-95%; less N if closer to 90-95%**

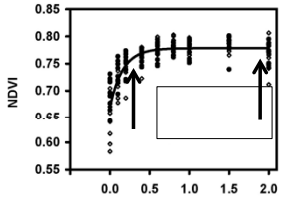
**Spectrum TCM500 NDVI units in relation to nitrogen application rate**




Relative to Well-Fertilized Turf as Reference,
Target 90 to 95% of Maximum

## Why Not Fertilize to Maximum Response?

- Increases likelihood of N loss from system

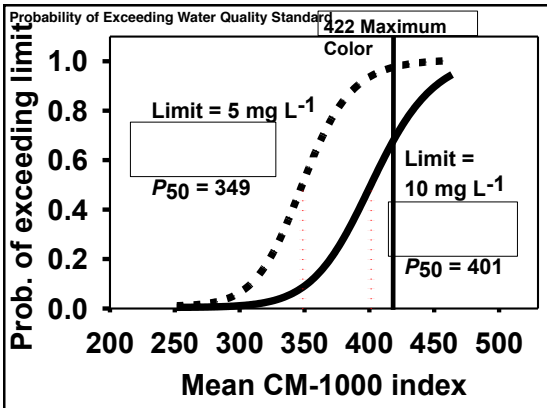



**Cannot visually judge optimum from excess**

## ***Probability of Exceeding Water Quality Standards & Regulations***

## from Fertilized Lawn Turf increases

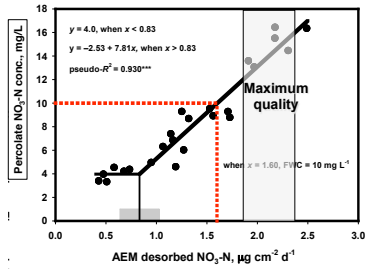
## as Turf Gets *Greener*




Barry, Guillard, and Mangiafico (2009, *Int. Turfgrass Soc. Res. J.* 11:933-947)

- Excess Amounts

**More loss with N applied past optimum**

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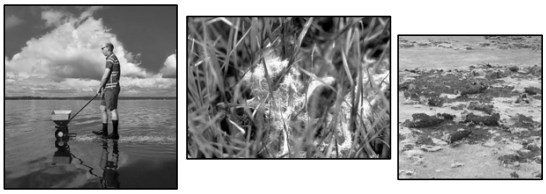
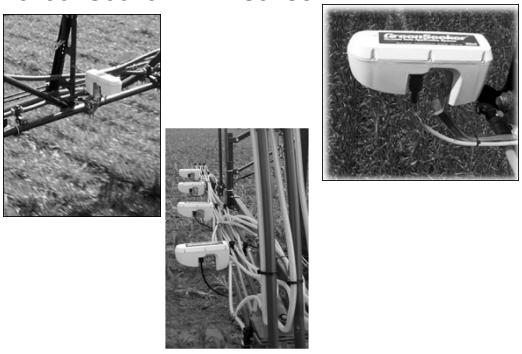
## Meters Can Prevent Excess N:

- Less Chance of Water Quality Concerns
- Less Chance of Wasting Fertilizer
- Less Chance of Diseases and Insects Associated with Succulent Turf



**GreenSeeker NDVI sensor**



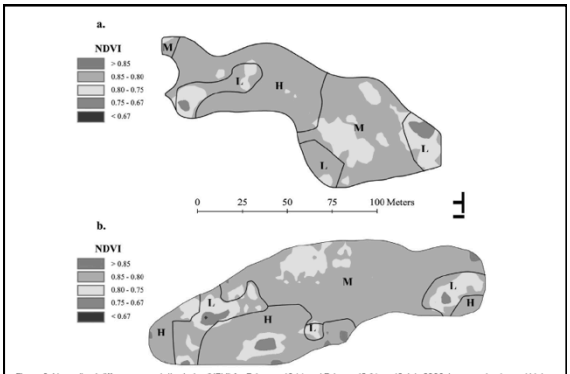
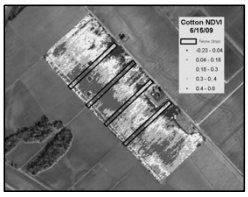
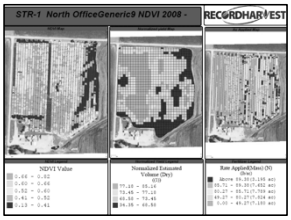


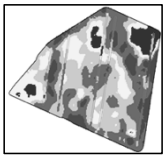

Figure 6. Normalized difference vegetative index (NDVI) for Fairways 10 (a) and Fairway 13 (b) on 12 July 2006. Low, moderate, and high SSMUs for the SD-Integrated classification method are denoted as L, M, and H, respectively, from Fig. 5.

**NDVI mapping used to guide irrigation – Krum et al., 2009**

**Objective – Field Mapping and N Availability**



**I think NDVI mapping can guide N fertilization for large turf areas**

**Until Reliable Test of N Developed to Guide N Fertilization of Turf:**

- **Categorize sites to N response: low, moderate, high**
- **Fertilize accordingly**
- **Lower rates more frequently better than higher rates infrequently or frequently**
- **Apply half normal rate (or less) and monitor response – if turf acceptable, do not apply more until response less than acceptable**

- **Consider slow-release or organic-based fertilizer – but could lead to long-term problems if putting on excess**
- **Consider lower N requiring species – fescues, low-input bluegrass, (junegrass, hairgrass, zoysiagrass)**
- **Follow earlier cutoff for fall fertilization program (Oct. 15 Southern NE; Sept. 15 Northern NE)**
- **Substitute Service for Product - consider soil fertility management same way as scouting in insect and disease management**
- **Consider reintroducing white clover (small-leafed form – "Dutch") as lawn species component to supply N**

**Challenges with all these suggestions and objective testing approaches**

- **Need to change current mindset to one using *more objective-based and site specific testing***
- **Following objective testing will give you more protection from liability; reduce pressure from regulation; result in healthier turf**

# Questions?

**karl.guillard@uconn.edu**

**http://www.turf.uconn.edu/guillard.shtml**